IN THE U.S. PATENT AND TRADEMARK OFFICE

J1036 U.S. PTO
09/933008
08/21/01

Applicant: LAU, James Ching Sik

Application No.: Group:

Filed: August 21, 2001 Examiner:

For: END CAP ASSEMBLY

Priority
Letter
10-11-01

L E T T E R

Honorable Commissioner of Patents
and Trademarks
Washington, D.C. 20231

August 21, 2001
1928-0122P-SP

Sir:

Under the provisions of 35 USC 119 and 37 CFR 1.55(a), the applicant hereby claims the right of priority based on the following application(s):

Country	Application No.	Filed
	2000-0020519.5	08/21/00

A certified copy of the above-noted application(s) is(are) attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. 1.16 or under 37 C.F.R. 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By: Joe McKinney Muncy

JOE MCKINNEY MUNCY
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The Patent Office
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Cardiff Road
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Signed M Cooke

Dated 24 July 2001

PATENTS FORM 1/77

Patents Act 1977
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1/77

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(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
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21AUG00 E562353 [illegible]
P01/7700 NP1000020519.5

1. **Your reference**

MRH.PO4412GB

2. **Patent application number**
(The Patent Office will fill in this part)

0020519.5

3. **Full name, address and postcode of the or of each applicant** *(underline all surnames)*

Johnson Electric S.A.
Rue Fritz-Courvoisier 40
CH-2300 La Chaux-de-Fonds
Switzerland

Patents ADP number *(if you know it)*

401831 3005

If the applicant is a corporate body, give the country/state of its incorporation

Switzerland

4. **Title of the invention**

END CAP ASSEMBLY

5. **Name of your agent** *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

A R Davies & Co
27 Imperial Square
Cheltenham
GL50 1RQ

Patents ADP number *(if you know it)*

570001

6. **If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and** *(if you know it)* **the or each application number**

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. **If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application**

Number of earlier application	Date of filing *(day / month / year)*

8. **Is a statement of inventorship and of right to grant of a patent required in support of this request?** *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

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Continuation sheets of this form	
Description	4
Claim(s)	2
Abstract	1 AML
Drawing(s)	4

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature A.R. Davies Date A R Davies & Co 21st August 2000

12. Name and daytime telephone number of person to contact in the United Kingdom

Mr M R Higgins
01242 524520

Warning

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Notes

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DUPLICATE

End Cap Assembly

This invention relates to an electric motor and in particular, to motors with improved EMI characteristics.

In many applications an electric motor is required which has low EMI emissions. In the past, this has been achieved by shielding the electric motor as much as possible and/or by adding EMI or noise suppression components such as chokes, capacitors and diodes into the motor circuitry, usually within the motor itself mounted on the end cap or even directly on the rotor.

These measures have had limited success but there has always been a trade off between cost and performance. As EMI requirements are becoming more strict, better EMI suppression is required.

Thus, there is a need for a miniature PMDC motor with reduced EMI emissions.

The present invention provides such a motor by incorporating a chip type EMI filter circuit into the circuitry of the motor.

Accordingly, the present invention provides an end cap for a miniature electric motor, the end cap being a body of insulating material and a cover of conductive material, wherein the body supports two brushes for making sliding contact with a commutator, two motor terminals for connecting a power supply to the brushes and a chip type EMI device having two input terminals, one terminal being connected to one of the two motor terminals and the other terminal being connected to the other motor terminal.

One preferred embodiment of the present invention will now be described, by way of example only, in which:

Figure 1 is a perspective view of an end cap according to the preferred embodiment of the present invention;

Figure 2 is an inside perspective view of the end cap of Figure 1;

Figure 3 is a perspective view of a cover being a part of the end cap of Figure 1;

Figure 4 is a perspective view of a body of the end cap of Figure 1;

Figure 5 depicts an EMI device as used in Figure 1;

Figure 6 depicts an earth spring as used in Figure 1;

Figure 7 depicts a brush leaf as shown in Figure 2;

Figure 8 depicts a brush holder as shown in Figure 2;

Figure 9 depicts a spring connector as shown in Figure 2;

Figure 10 is a detail view of the connection of the brush holder with the spring connector of Figure 2; and

Figure 11 is a detail view of the assembly of the earth spring of Figure 6.

The preferred end cap 20 is shown in Figures 1 and 2, Figure 1 being a plan view or outside view and Figure 2 being a view from below or an inside view as this side of the end cap is covered in use by a motor housing. The end cap has a body 22 of insulating material and is preferably a plastics injection molded part. The outer side of the end cap is covered by a conductive cover 24 which is pressed from sheet metal. The cover has a central boss 26 forming a retainer for a bearing for a rotor shaft.

As shown in Figure 3, the cover 24 has four round holes 28 and two rectangular holes 30, 32. The four round holes 28 receive fixing posts 34 formed on the body 22 for fixing the cover 24 to the body by a staking process. One of the rectangular holes 30 accommodates the EMI device 36 while the other 32 receives a projection 38 formed on the body. The posts 34 and projection 38 are more clearly shown in Figure 4. Figure 4 also shows an integral compartment 40 formed on the upper surface of the body for receiving the EMI device. The compartment 40 is divided into halves by a slot 42.

The EMI device is shown in Figure 5. It is a chip type device being a small rectangular prism with terminals 44 at each axial end and two earth terminals 46 midway between the axial ends, one on each of the narrower side faces. The preferred EMI device is a layered architecture noise canceling chip device available

from X2Y Inc. An earth connector 48 in the form of a W-shaped conductive wire spring, as shown in Figure 6, connects both earth terminals 46 to the cover 24.

The body 22 supports the electrical components of the end cap. Figure 2 shows the body supporting motor terminals 50, fingerleaf brushes 52, brush holders 54 and spring connectors 56. The fingerleaf brushes 52 (Figure 7) are strips of a resiliently flexible conductive material such as beryllium copper. The distal end of the brush leaf has been separated into three fingers 58, forming a co-called fingerleaf brush. Each brush 52 is connected, by upset rivets 60, to a brush holder 54 which fixes the brush 52 to the body 22. Motor terminals 50 extend from apertures in the body along grooves 64 to make resilient contact with the brush holders 54. While female motor terminals are shown, male terminals are also possible.

The brush holders 54, more clearly shown in Figure 8, have a barb 66 which is pressed into a slot 68 in the body for fixing the brush holder in position and hence, the brushes. The spring connectors 56 make resilient contact with the respective brush holders and extend through apertures 70 in the body into opposite ends of the compartment 40 for the EMI device 36. The spring connectors 56 (Figure 9) are of conductive spring material such as brass and the distal ends are arranged to make resilient electrical contact with the terminals 44 of the EMI device 36 while accommodating variations in size between individual EMI devices due to manufacturing tolerances.

Figure 10 shows in detail the arrangement of the spring connector 56. The brush leaf 52 is fixed to the brush holder 54 by upset rivets 60 and the join is located in a slot 72 in the body. The spring connector has a 'U'-shaped end which is pressed into the slot 72 with the brush holder 54 and the brush leaf 52. The end has dimples 74 for making better contact with the brush holder 54. The spring connectors 56 thus straddles the respective brush holder 54, brush leaf 52 and a wall 76 of the body 22 with the other end extending through the body and into the compartment 40 for the EMI device 36 located on the other side of the body 22.

Figure 11 illustrates in detail the earth connection. The EMI device has two earth terminals 46 located midway along the narrower sides. The earth spring 48, which is similar to a 'W' in shape is located in the slot 42 in walls of the compartment 40 thus locating the earth spring 48 axially along the length of the EMI device 36. The outer legs 78 of the spring press against inner edges of the rectangular hole 30 in the cover

24 while the outer legs 78 also resiliently bear against the earth terminals 46 of the EMI device 36.

Although only one preferred embodiment has been described, variations will be apparent to those skilled in the art and it is intended to cover all such variations as fall within the scope of the appended claims.

Claims

1. An end cap for a miniature electric motor, the end cap being a body of insulating material and a cover of conductive material, wherein the body supports two brushes for making sliding contact with a commutator, two motor terminals for connecting a power supply to the brushes and a chip type EMI device having two input terminals, one terminal being connected to one of the two motor terminals and the other terminal being connected to the other motor terminal.

2. An end cap according to Claim 1, wherein the chip type EMI device has at least one earth terminal which is connected to the conductive cover.

3. An end cap according to Claim 2, wherein the at least one earth terminal of the EMI device is connected to the conductive cover by a conductive spring.

4. An end cap according to Claim 3, wherein the EMI device has two earth terminals and the conductive spring is 'W'-shaped.

5. An end cap according to Claim 3 or 4, wherein the cover has a recess in which the EMI device is located and the spring engages an edge of the recess to establish electrical contact between the or each earth terminal of the EMI device and the cover.

6. An end cap assembly according to any one of the preceding claims, wherein the body has an integrally formed compartment for accommodating the EMI device.

7. An end cap assembly according to any one of the preceding claims, wherein the EMI device is held between a pair of electrical conductive connectors.

8. An end cap according to Claim 7, wherein the connectors are spring connectors which make resilient contact with the input terminals of the EMI device.

9. An end cap according to Claim 7 or Claim 8, wherein the brushes comprise resiliently flexible conductive strips connected to relatively rigid brush holders and the spring connectors are electrically connected to the motor terminals by way of the brush holders.

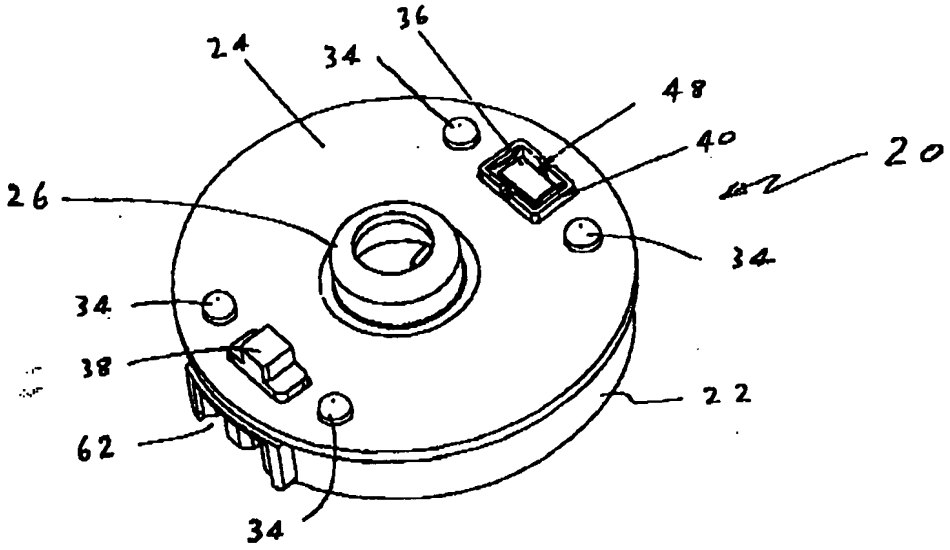
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FIG. 1

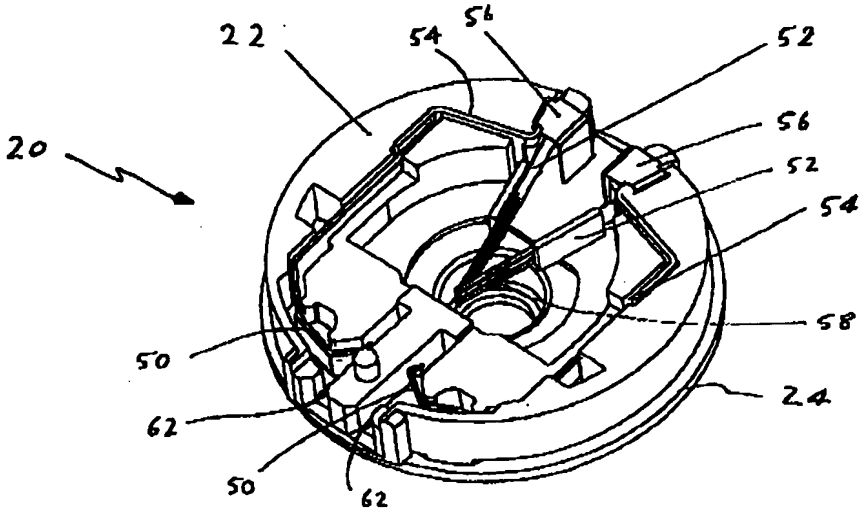
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FIG. 2

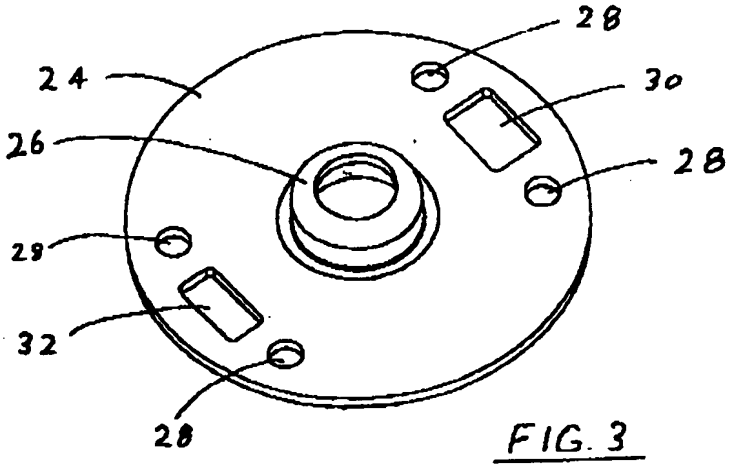

FIG. 3

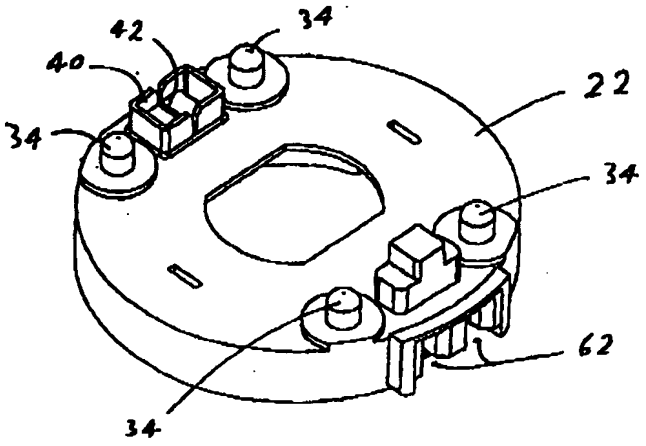

FIG. 4

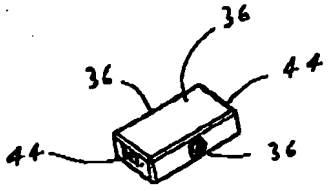

FIG. 5

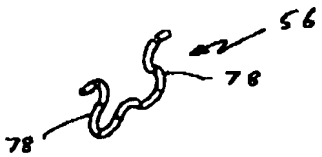

FIG. 6

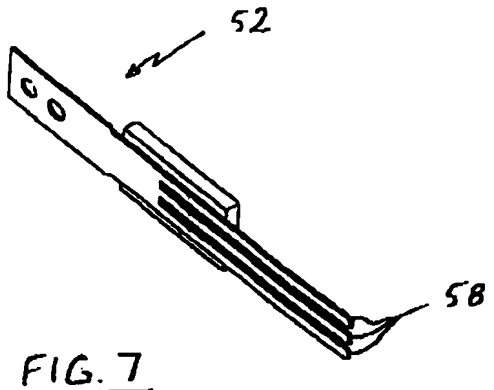

FIG. 7

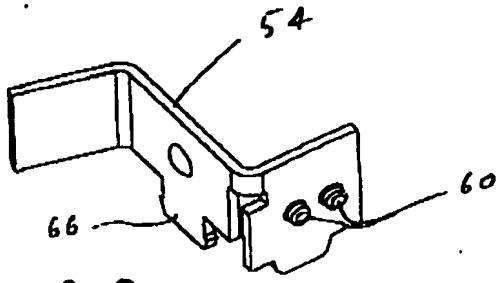

FIG. 8

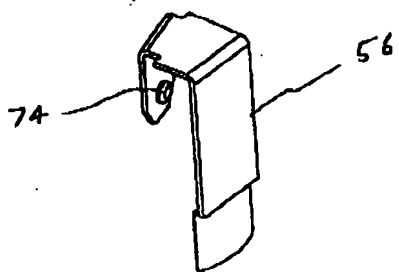

FIG. 9